Kentucky Geological Survey
UNIVERSITY OF KENTUCKY

Kentucky Geology

Earth Resources—Our Common Wealth

September 2000 **Volume 1, Number 2**

Kentucky Geological Survey
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Our Mission:
To collect, preserve, and distribute information about mineral and water resources and the geology of the Commonwealth.

KGS has conducted research on the geology and mineral resources of Kentucky for more than 160 years, and has developed extensive public databases for oil and natural gas, coal, water, and industrial minerals that are used by thousands of citizens each year. The Survey's efforts have resulted in topographic and geologic map coverage for Kentucky that has not been matched by any other state of large size.

Innovative research for reducing CO_2

Geologic sequestration of CO_2

In October 2000, the Kentucky Geological Survey will receive $476,000 as part of a $2.4 million grant from the U.S. Department of Energy for a 3-year, multistate research project to investigate methods to reduce concentrations of carbon dioxide, a greenhouse gas. Throughout the past 100 years, the combustion of fossil fuels in coal-fired electric power plants, industrial activities, vehicles, and other uses has increased the emission of carbon dioxide that may be contributing to global warming.

Water vapor, carbon dioxide (CO_2), and methane trap heat in the Earth's atmosphere. Without these gases, the Earth would be too cold to sustain life as we know it. If human activities, however, introduce more greenhouse gases into the atmosphere than the land and oceans can absorb, more warming than is natural will occur.

Geologic sequestration—a process of injecting CO_2 in underground geologic formations—may be one way to safely manage CO_2 emissions over long periods of time. Potential sites in Kentucky for sequestering carbon dioxide include oil and gas fields, unmineable coal beds, abandoned underground mines, and saline aquifers. This process may also enhance the production of oil and natural gas and provide economic uses for wells and mines that might otherwise be unused.

Geologists at KGS will be cooperating with researchers in four states to develop a database, which will integrate regional information on CO_2 sources with potential sites for geologic sequestration. For more information, contact **Jim Drahovzal** at (859) 257-5500 ext. 154 or at drahovzal@kgs.mm.uky.edu.❖

*"The goal is to create a planning tool that will allow users to assess various strategies for sequestering CO_2 in the Midcontinent," said **Jim Drahovzal,** leader of the project at KGS. "We want to provide a sound knowledge base that will allow for well-informed policy decisions."*

Kentucky River Basin

Safe drinking water for communities in eastern Kentucky

Jim Dinger and **Robert Andrews** are using state-of-the-art technology to evaluate the potential for high-yield water wells in the upper Kentucky River Basin. Images from satellites, aerial photography, hydrogeologic information, and drilling are used to locate high-yield wells for major supplies of potable water. Satellite imagery and aerial photography help define the general locations of fractures in the Earth's crust. Hydrogeologic data are then used in connection with drilling to locate fractures that will produce significant amounts of ground water. A grant of $35,000 from the Kentucky River Authority is supporting the continuation of this project.

Dennis Cumbie and **Jim Dinger** are using modern hydrologic expertise to develop techniques for using deep, underground, abandoned coal mines for water supplies in the Kentucky River Basin. Many of these mines contain millions of gallons of water that can be used as a principal or backup source of ground water for communities and industry. KGS is determining the volume and quality of the water available for this use. A grant of $41,695 from the Kentucky River Authority is supporting the continuation of this research.❖

Mystery map

Do you know what this is? For more information, turn to page 4.

Director's Desk

When I became State Geologist last October, I was eager to visit all departments of geology in Kentucky universities and get acquainted with faculty and students. These visits turned into opportunities to talk directly with students, and I found myself inviting them to visit the Kentucky Geological Survey (KGS). I personally owe a lot to my early experiences as a student working for a geological survey, so I wanted to ensure that other students had similar opportunities. This spring I established student summer internships at KGS. I am grateful to **Frank Ettensohn** and **Sue Rimmer** of the Department of Geological Sciences at the University of Kentucky for establishing an independent study course to enable the interns to receive credit for the internship, and **Mike Nietzel**, Dean of the Graduate School, for providing scholarship funds to support a graduate student intern. I trust that the new knowledge and experiences the interns have gained will propel them in their careers. Details of this program are described in the ***In Focus*** feature.

This summer also witnessed another important development in support of enhanced geoscience education for students in Kentucky. On August 11, the inaugural meeting of the Coalition of Kentucky Geoscience Departments was held in Lexington. This coalition of academic and practicing geologists from across the state met to discuss avenues for cooperation and collaboration to strengthen geoscience education and address new educational standards established by the Kentucky Council on Postsecondary Education. We will continue to keep you up to date on developments from the coalition in future issues of our newsletter.

As many of you know, KGS has a longstanding tradition of research conducted across the state of Kentucky for the benefit of the Commonwealth. We are introducing a new feature, ***Field Notes from Across Kentucky,*** in which we provide brief notes on research projects, field investigations, and other activities we are conducting in locations across the state.

In the current issue of ***Kentucky Geology*** you will also find a summary of new grants KGS has received and a discussion of upcoming events of interest to geoscientists. In the past few months, we have secured $1,019,582 in additional grant funding for investigations of water quality and supply, ground-water protection, coal assessment, and geologic sequestration of carbon dioxide. I encourage you to contact the Survey to ask questions about these projects, and to find out more about how we can help you.

Many of you have called me to comment on our newsletter. I have enjoyed hearing from you, and I welcome your feedback and comments in the future.❖

James C. Cobb

Strengthening geoscience education

Coalition of Kentucky Geoscience Departments

An inaugural meeting of the Coalition of Kentucky Geoscience Departments was held in Lexington on August 11, 2000. Members of this coalition of university faculty and representatives from the Kentucky Board of Registration for Professional Geologists, the Kentucky Society of Professional Geologists (KSPG), the Kentucky Section of the American Institute of Professional Geologists (AIPG), and the Kentucky Geological Survey (KGS) share a common commitment—to strengthen geoscience education in Kentucky for the benefit of students and society. The chairs and faculty from Eastern Kentucky University, Morehead State University, Murray State University, Northern Kentucky University, Western Kentucky University, and the University of Kentucky participated.

Knowledge of earth science has always been essential worldwide for economic development, resource management, environmental protection, and response to and preparedness for geologic hazards such as floods, landslides, and earthquakes. The need for geoscience expertise has never been greater as economic reserves of vital fossil fuels are exploited, expanding industrial activity and population growth continue to push businesses and communities to areas more prone to geologic hazards, and rapid economic growth stress the water and air resources of our environment. Ironically, despite these pressing needs, there is a disturbing lack of public awareness and understanding of earth science.

The coalition members identified ways in which they can cooperate to strengthen geoscience education at each university, collaborate in course offerings to achieve efficiency and increase student enrollments, avoid unnecessary duplication, and heighten public awareness of the importance of geoscience education. This initiative is designed to meet the productivity standards for geoscience education established by the Kentucky Council on Postsecondary Education.

Geologists, by working together, can strengthen geoscience education in Kentucky. If you would like more information, please contact the chair of the department of geology at your alma mater.❖

"A chance of a lifetime"

This spring, the corridors of the Mining and Mineral Resources Building were buzzing with excitement and activity with the presence of four summer interns. Recalling the valuable experience he had gained while working at the Illinois State Geological Survey as an undergraduate at the University of Illinois, State Geologist **Jim Cobb** wanted other students to have similar opportunities. Four student interns, **Bethany Overfield, Hannah Harbin, Matt Crawford,** and **Sarah Hawkins,** participated in the internship and earned credit in an independent studies course at the University of Kentucky this summer.

Bethany, a senior in geology this fall at Western Kentucky University, would like to work in topics of geology that concern the environment. Hannah, a junior in geology this fall at Hanover College in Indiana, would like to be involved in earth-resources conservation from a geologic standpoint, to provide expertise to have a significant political impact. Matt, a master's student in geology at Eastern Kentucky University, is interested in metamorphic petrology, tectonics, and geologic mapping. Sarah, a senior in geology at the University of Kentucky, is interested in public policy and outreach, and igneous and metamorphic petrology.

The interns were introduced to diverse research activities including digital geologic mapping, Global Positioning System (GPS) measurement, seismic research for oil and natural gas exploration, palynology and coal-quality studies, geologic sequestration of carbon dioxide gas, hydrogeology, minerals and geologic mapping, curation of mineral and fossil collections, professional registration for geologists, and earth-science education and public outreach. Friday afternoons were devoted to mentoring sessions in which a KGS staff member shared his or her expertise and current research interests. The interns conducted field work and research to write articles for the county geology project featured on the KGS Web site at www.uky.edu/KGS/coal/webgeoky/county/county.html. Field trips provided for the interns included a tour of two underground quarries, the Ghent power plant, and the Star Fire Mine. Jeff Crevier and Kristin Toth, two summer students employed at KGS, also participated in the mentoring sessions and field trips.❖

"I consider my internship at KGS this summer a chance of a lifetime."
—Hannah Harbin

"My experience as an intern at the Kentucky Geological Survey has been unprecedented in my collegiate career. I have been given a most helpful perspective of geology at the state level. I believe that each person that I encountered at the Survey has a mission of teaching me as much as possible, and for that, I am grateful."—Bethany Overfield

"I find myself loving every aspect of the science [of geology] and learning new things everyday. I would like to begin my career working for a state survey. I think being surrounded by exceptional scientists in a research environment would be a good way to begin a career. Working for a state survey would also be a good way to assist in promoting geology to the public. Also, being a teaching assistant in graduate school has had me thinking about teaching in the future. I think my internship at the Kentucky Geological Survey this summer is a perfect road to either aspiration."—Matt Crawford

"The most important experience that I have gained at KGS has been one that could never be reproduced within an academic setting. I have learned the real-life practical uses and applications for the principles and techniques that are taught in the classoom."
—Sarah Hawkins

Left to right: Matt Crawford, Jeff Crevier, Sarah Hawkins, Kristin Toth, Hannah Harbin, and Bethany Overfield.

Making research results available to the public

Publications and digital map data online

Many KGS publications and maps are now available on our Web site in portable document format (PDF) files. A list of publications available online and accompanying abstracts can be found at www.uky.edu/KGS/pubs/kgspublications.html. A list of maps and geographic information system (GIS) coverages available in digital format can be found at www.uky.edu/KGS/gis/intro.html.

A sample data set for a 7.5-minute quadrangle is available at www.uky.edu/KGS/mapping/pages/questionnaire.html. KGS is making the files available in several different formats to seek feedback from potential users about how they prefer to receive data. A questionnaire is included to obtain input from potential users and help the Survey make decisions about the most appropriate formats for providing digital map data to the public.

The sample data set has all the key elements that constitute a digital map (for example, formation areas, contacts, faults). The data will be of interest to geologists, engineers, educators, and anyone else interested in digital geologic maps. For more information, contact **Jerry Weisenfluh** at (859) 257-5500 ext. 114 or at jerryw@kgs.mm.uky.edu.❖

New digital map product

Answer to mystery map

For a limited time, KGS is making available well locations plotted on digital raster graphic topographic maps (DRG's). Oil, gas, and water well locations, as well as coal-boring locations, are being plotted on scanned, georeferenced images of standard U.S. Geological Survey topographic maps. These new maps were projected using

the 1927 North American datum (NAD 27) and universal transverse Mercator (UTM) (zone 16 or 17). The cost of each map with well locations plotted on a single DRG base, with a list of the wells or coal-boring locations, is $75. For more information, contact **Steve Cordiviola** at (859) 257-5500 ext. 150 or at scordiviola@kgs.mm.uky.edu. To place an order, contact our Publication Sales office at (859) 257-3896, or customers outside of Lexington can call toll-free at 1-877-778-7827. You may also submit your order by e-mail to pubsales@kgs.mm.uky.edu.❖

Serving the public

New KGS publications

"Overview of Environmental Regulations That Affect Coal Combustion," by Cortland Eble

Although we continue to rely on coal for generating electricity, environmental regulations have made its use as a fuel source a challenge. Eble outlines pertinent Federal regulations on air emissions, discusses options available to electric utilities for complying with regulations, and examines the implications for the deregulation of the electric-power industry. <www.uky.edu/KGS/pubs/coalregs.pdf>

"Effects of Longwall Mining on Hydrology, Leslie County, Kentucky; Part 2: During-Mining Conditions," by Shelley Minns Hutcheson and others

This is the second of three reports on the effects of longwall coal mining on hydrogeology in the Edd Fork watershed in southern Leslie County. The authors discuss the effects of subsidence caused by longwall mining on water quality and the ground-water flow system. <www.uky.edu/KGS/pubs/RI4_12.pdf>

"The Effect of Turfgrass Maintenance on Surface-Water Quality in a Suburban Watershed, Inner Blue Grass, Kentucky," by Michael Williams and others

The authors examine the effect of the use of fertilizers and pesticides on surface-water quality in a suburban watershed in the Inner Blue Grass. They conclude that if the application rates recommended by the manufacturers or the University of Kentucky Cooperative Extension Service are followed properly, these chemicals have little impact on the quality of surface water. <www.uky.edu/KGS/pubs/turfgrass.pdf>

"Generalized Geologic Bedrock Conditions as Related to Solid-Waste Landfills in Kentucky," by Martin C. Noger

This map, which has general information about the conditions of geologic bedrock throughout the state, will be important to consider when selecting sites for disposal of solid waste. <www.uky.edu/KGS/gis/intro.html#new>

To obtain copies of these publications, call the KGS Publication Sales office at (859) 257-3896 or toll-free at 1-877-778-7827 for customers living outside of Lexington.❖

Water resources

Nonpoint-source pollution

Steve Fisher and **Jim Dinger** are evaluating ground-water data from the Kentucky Ground-Water Data Repository maintained by KGS to assess nonpoint-source pollution of ground water. The watersheds being studied are the upper and lower Cumberland, Tradewater, and Green Rivers, and the many smaller watersheds that drain directly to the Mississippi River from the Jackson Purchase Region. This investigation is funded by a research grant of $60,000 for 1 year provided by the Kentucky Division of Water.

Fisher and Dinger are also expanding ground-water monitoring for assessment of nonpoint-source pollution.This 2-year research project will establish 30 monitoring sites in the upper and lower Cumberland River Basins and the Jackson Purchase Region to help characterize ground-water quality in these watersheds. A research grant of $56,980 has been provided by the Kentucky Division of Water to fund this research.❖

Karst hydrology

Jim Currens and **Jim Dinger** are developing a poster designed to help prevent nonpoint-source pollution in karst terranes. The poster will be used to explain the nature of ground- and surface-water interaction with regard to pollution from various land uses in karst terranes. Ground water in karst terranes is particularly vulnerable to pollution. A grant of $10,000 from the Section 319 program of the Kentucky Division of Water is funding this research.❖

Eastern Kentucky Coal Field

Jim Dinger and **Doug Graham** are studying water quality and land settlement at a large surface coal mine in the Eastern Kentucky Coal Field. This research is supported by a grant of $25,000 for 1 year from the University of Kentucky E.O. Robinson Trust.❖

Western Kentucky Coal Field and Jackson Purchase

Glynn Beck and **Jim Dinger** are assessing the reasons for high nitrate concentrations in ground water used as domestic water supplies in the Western Kentucky Coal Field and Jackson Purchase Region. They are also examining possible ways to reduce the nitrate concentrations in individual wells and eliminate sources of high nitrate that recharge ground-water systems. This research is supported by a grant of $86,284 from the University of Kentucky College of Agriculture.❖

Muhlenberg County

Jim Dinger and **Carlos Galcerán** are assessing the quality of ground water and surface water at the Wendell H. Ford National Guard Center in Muhlenberg County. A long-term monitoring plan is being developed and tested to measure the effects of land use on water quality. This investigation is supported by a grant of $228,500 from the Kentucky Army National Guard.❖

Geologic hazards research to create safer communities

Central United States Partnership

On May 22–24, 2000, at the Kentucky Dam Village State Resort Park, officials from across the nation gathered together to address geologic hazards and emergency-response planning issues that affect the central United States. The meeting was organized by the Central United States Partnership (CUSP), which was recently established to serve as an umbrella organization to produce and implement a long-term strategic plan to reduce risk from damaging earthquakes in Arkansas, Kentucky, Illinois, Indiana, Missouri, Mississippi, and Tennessee.

CUSP is designed to be a working partnership, and is led by the Central United States Earthquake Consortium and advised by a Seismic Advisory Council composed of partner representatives. Meeting participants discussed strategies for living with earthquakes, building for earthquakes, and learning about earthquakes. For more information, contact **John Kiefer** at (859) 257-5500 ext. 145 or at kiefer@kgs.mm.uky.edu.❖

Coal resources

Coal-resource assessment

A grant of $100,000 from the U.S. Geological Survey will be used to assess the availability of coal resources in the two major coal fields in Kentucky. **Drew (William) Andrews** is the principal investigator for this project.

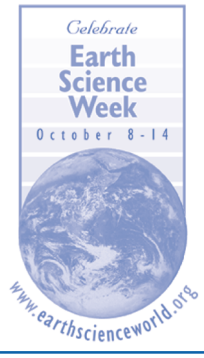
A $15,000 grant from the U.S. Geological Survey, for the National Coal Resources Data System, will be used by KGS coal geologists to compile coal information for a national database. **Steve Greb** is the principal investigator for this project.❖

The future of Illinois Basin coal

In the past decade there have been an unparalleled number of changes in the coal and electric-power-producing industries in the Illinois Basin, which includes parts of Kentucky, Illinois, and Indiana. The state geological surveys of Kentucky, Illinois, and Indiana, and the U.S. Geological Survey are co-convening a 1-day symposium to promote an exchange of ideas by people involved with these changes, as well as those affected by them. The symposium will be held on October 25, 2000, at the Courtyard Marriott in Indianapolis, Ind. For more information, please contact **Cortland Eble** at (859) 257-5500 ext. 149 or at eble@kgs.mm.uky.edu.❖

Earth Science Week

During the third annual Earth Science Week, October 8–14, 2000, KGS personnel will give presentations on hydrogeology and guided tours for elementary and middle-school children at McConnell Springs, an environmental and educational park in Lexington. For more information, contact **Carol Ruthven** at (859) 257-5500 ext. 128 or at cruthven@kgs.mm.uky.edu.



The Department of Geological Sciences at the University of Kentucky will be hosting an open house for the public in the evening of October 11 and will conduct a geologic field trip for teachers on October 14. For more information, please contact **Dave Moecher** at (859) 257-6939 or at moker@pop.uky.edu.❖

KSG mailing list

Would you like to receive the KGS newsletter and announcements of meetings and new publications? If so, we would like to add your name to our electronic mailing list. Please call us at (859) 257-5500 or send an e-mail message to **Jennifer Talley** at jtalley@kgs.mm.uky.edu—simply type "Electronic-Mailing List Addition" in the subject line of your message, type your mailing address and phone and fax number in the message—and we will include your name and address in our mailing list.❖

Calendar of events

- **October 17–19:** 45th Annual Midwest Ground Water Conference, Holiday Inn East in Columbus, Ohio <www.epa.state.oh.us/ddagw/mwgwc.html>
- **October 25:** "Illinois Basin Coal: What is the Future," Illinois Basin Consortium, Courtyard Marriott, Indianapolis, Ind. <www.uky.edu/KGS/announce/ibccoalsymposium.pdf>
- **November 2–4:** "Geology of the Jackson Purchase Area," Kentucky Society of Professional Geologists' annual field trip <www.kspg.org>
- **November 9–18:** Summit 2000, Geological Society of America annual meeting and exposition, Reno, Nev. <www.geosociety.org/meetings/2000/>❖

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Address correction requested